CTSD gene

cathepsin D

Normal Function

The *CTSD* gene provides instructions for making an enzyme called cathepsin D. Cathepsin D is one of a family of cathepsin proteins that act as protease enzymes, which modify proteins by cutting them apart. Cathepsin D is found in many types of cells and is active in lysosomes, which are compartments within cells that digest and recycle different types of molecules. By cutting proteins apart, cathepsin D can break down certain proteins, turn on (activate) other proteins, and regulate self-destruction of the cell (apoptosis).

Cathepsin D is produced as an inactive enzyme, called a preproenzyme, which has extra protein segments attached. These segments must be removed, followed by additional processing steps, for the enzyme to become active. The mature, active cathepsin D enzyme is made up of two parts, one light chain and one heavy chain.

Health Conditions Related to Genetic Changes

CLN10 disease

At least seven mutations in the *CTSD* gene have been found to cause CLN10 disease. The signs and symptoms of CLN10 disease are usually present at birth and include muscle rigidity, respiratory failure, and severe seizures; death typically occurs in infancy. Rarely, CLN10 disease can develop later in life with poor coordination and balance (ataxia), loss of speech, a gradual loss in intellectual functioning (cognitive decline), and vision loss.

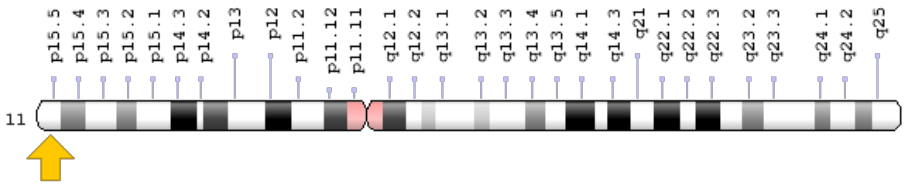
CTSD gene mutations found to cause CLN10 disease that is present at birth lead to a complete lack of cathepsin D enzyme activity. As a result, proteins and fats are not broken down properly and abnormally accumulate within lysosomes. While these substances accumulate in cells throughout the body, nerve cells appear to be particularly vulnerable to damage caused by the abnormal cell materials. Early and widespread loss of nerve cells in CLN10 disease leads to severe signs and symptoms and death in infancy.

In the later-onset cases of CLN10 disease, *CTSD* gene mutations likely result in the production of a cathepsin D enzyme whose function is greatly reduced but not eliminated. As a result, some proteins and fats are broken down by the enzyme, so it takes longer for these substances to accumulate in lysosomes and cause nerve cell death.

Chromosomal Location

Cytogenetic Location: 11p15.5, which is the short (p) arm of chromosome 11 at position 15.5

Molecular Location: base pairs 1,752,752 to 1,763,992 on chromosome 11 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- CATD_HUMAN
- cathepsin D preproprotein
- ceroid-lipofuscinosis, neuronal 10
- CLN10
- CPSD
- lysosomal aspartyl peptidase
- lysosomal aspartyl protease

Additional Information & Resources

Educational Resources

- Jasper's Basic Mechanisms of the Epilepsies (fourth edition, 2012): Neuronal Ceroid Lipofuscinoses
  https://www.ncbi.nlm.nih.gov/books/NBK98154/#lehesjoki.s8

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28CTSD%5BTIAB%5D%29+OR+%28cathepsin+D%5BTIAB%5D%29%29+AND+%28%28Genes%5BMH%5D%29+OR+%28Genetic+Phenomena%5BMH%5D%29%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+1080+days%22%5Bdp%5D

OMIM

- CATHEPSIN D
  http://omim.org/entry/116840

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/GC_CTSD.html
- ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=CTSD%5Bgene%5D
- HGNC Gene Family: Cathepsins
  http://www.genenames.org/cgi-bin/genefamilies/set/470
- HGNC Gene Symbol Report
  http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=2529
- NCBI Gene
  https://www.ncbi.nlm.nih.gov/gene/1509
- UniProt
  http://www.uniprot.org/uniprot/P07339
- University College London: CTSD Gene Mutation Database
  http://www.ucl.ac.uk/ncl/CLN10CTSDmutationtable.htm

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